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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/576,724

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Laurent Labrousse

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EXAMINER

LIAO, DIANA J

ART UNIT

PAPER NUMBER

1793

NOTIFICATION DATE

DELIVERY MODE

06/11/2009

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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<b>Office Action Summary</b>	<b>Application No.</b> 10/576,724	<b>Applicant(s)</b> LABROUSSE ET AL.	
	<b>Examiner</b> DIANA J. LIAO	<b>Art Unit</b> 1793	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period **will** apply and **will** expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply **will**, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 26 March 2009.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 14-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13 and 20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                 | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date: _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                        | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date: _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Status of Application***

Claims 1-13 and 20 are presented for examination.

The indicated allowability of claims 3 and 12 is withdrawn in view of the newly discovered reference(s) to Chambers et al. Rejections based on the newly cited reference(s) follow.

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-13 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi, et al. ("Photocatalytic properties of TiO<sub>2</sub>/WO<sub>3</sub> bilayers..." 2003) in view of Chambers, et al. ("Epitaxial growth and properties of ferromagnetic co-doped TiO<sub>2</sub>

Art Unit: 1793

anatase", 2001), Zeman, et al. ("Nano-scaled photocatalytic TiO<sub>2</sub>..." 2003), Zhang, et al. ("Surface modification of TiO<sub>2</sub> film by iron doping..." 2003) and Doushita, et al. (US 6,576,344).

Takahashi, et al. teaches a deposited TiO<sub>2</sub> film possessing photocatalytic properties. The layers are deposited at room temperature by sputtering onto glass-slide substrates. WO<sub>3</sub> is deposited first to a thickness of 0.9-3.5 μm. A TiO<sub>2</sub> film is then deposited onto the WO<sub>3</sub> film. Photocatalytic properties have been confirmed. (pg 1410, Experimental Procedure)

Takahashi, et al. does not teach the mechanics of the layer deposition to be exactly as claimed, but since this is a product claim and the article of the prior art has an underlayer and an overlayer created without heating (at room temperature) with an achieved photocatalytic property, the limitations are found to be met. The underlayer has in some way effected the creation of a photocatalytic layer, which is closely related to its crystalline structure. As will be discussed later, the anatase phase and an anti-soiling property are found to have been inherently met through the use of magnetron sputtering and also with the presence of photocatalytic ability.

Takahashi, et al. does not teach an underlayer with a thickness between 10 and 100 nm. Takahashi, et al. also does not mention that the glass substrate contains an additional layer below the underlayer. Takahashi, et al. also does not teach an overlayer. Takahashi, et al. also does not teach the use of dopants in the TiO<sub>2</sub>-based layer. Takahashi, et al. does not teach the use of an ATiO<sub>3</sub> underlayer.

Regarding the thickness of the films, Zeman, et al. teaches the creation of photocatalytic TiO<sub>2</sub> films by magnetron sputtering. Zeman, et al. teaches that a film with a thickness below 100nm with photocatalytic ability is desirable because it would cut down production time. Magnetron sputtering is a slow process and thus creating a thin film would be significantly faster than creating a thicker film. (pg. 57)

One would be motivated to create thinner films because Zeman, et al. teaches that a thin film can still be rendered photocatalytic or useful and that it would take significantly less time due to the slow nature of magnetron sputtering. Therefore, due to slow speed at which sputtering creates a film, it would have been obvious to one of ordinary skill in the art to create as thin a film as effectively possible in order to save time, including the underlayer, which Takahashi, et al. teaches to be also created by sputtering.

Regarding the use of a dopant such as N, Fe, or Zr, Zhang, et al. teaches the effects of iron doping on the properties of a sputtered TiO<sub>2</sub> film. In certain applications, Fe-doped TiO<sub>2</sub> films have been found to have higher activity than pure TiO<sub>2</sub> films. (pg 337, Conclusions) One of ordinary skill would have been motivated to incorporate iron into the TiO<sub>2</sub> film since it is known in the art that at least in certain applications, an increase in photocatalytic ability can be achieved by a limited amount.

Regarding an overlayer and an alkali-blocking sublayer adjacent to the underlayer, Doushita '344 teaches a photocatalytic article with anti-soiling properties containing a metal oxide semiconductor and one other element, with an overcoat layer of titanium oxide. (claim 17) A preferred metal oxide semiconductor is  $\text{TiO}_2$  because it is high in catalytic activity and stable. (col 3, lines 41-48) The substrate is preferably glass with an alkali-blocking film. (claim 13) Doushita '344 is found to fairly teach that a photocatalytic article such as  $\text{TiO}_2$  inherently has an anti-soiling capability because Doushita '344 teaches anti-soiling articles with the only guidance being providing a photocatalytic layer.

One would have been motivated to add an overlayer as taught in Doushita '344 because an overlayer is found to improve the anti-fogging and anti-soiling functions of the photocatalyst layer. (col 10, lines 20-24) One would have been motivated to include an alkali blocking film because Doushita '344 teaches that when a glass substrate is used, such as in Takahashi, et al., an alkali-blocking film should be employed in order to prevent the migration of alkali ions which would affect the crystallinity and thus photocatalytic ability of the titanium oxide. (col 4, lines 18-31)

One of ordinary skill in the art would have been motivated to combine the teachings of Doushita '344 with that of Takahashi, et al. because of the similar applications as photocatalysts, in both UV and visible light spectra.

Regarding an additional sublayer to the underlayer having a functionality, it would have been obvious to one of ordinary skill in the art to incorporate additional layers

depending on the intended use. Doushita '344 recites many uses for photocatalytic films, such as air conditioner heat exchanger fins (which may require a thermal control or conducting layer), and mirrors and lenses (which may require an optical functionality). (col 1, lines 12-27) Therefore, the addition of an additional layer below the underlayer and TiO<sub>2</sub>-based layer is not found patentable over the prior art. All additional layers are also not found to interfere with the anti-soiling abilities, as Doushita '344 only teaches the extra layers to enhance the ability.

Regarding a glazing or a coating incorporating a TiO<sub>2</sub>-based antisoiling layer and underlayer and possibly including at least one other layer on another external face, it would have been obvious to one of ordinary skill in the art to use the glazing on all appropriate surfaces of a structure depending on the intended use. As in the case of catalysis, if the reaction occurring involves compounds in the environment, as in a liquid or gas environment such as the treatment of water, it would have been obvious to one ordinary skill in the art to use the glazing on all possible faces of the structure in order to increase catalytic surface area.

Regarding the creation of an anatase layer, the prior art appears to show that the creation of an anatase phase is inherent in the use of magnetron sputtering, especially when creating a layer with photocatalytic ability. Both Zeman, et al. and Zhang, et al. teach the creation of anatase films (see respective abstracts) and do not discuss the creation of any other phase when creating the film using magnetron sputtering. In

Art Unit: 1793

addition, Zeman, et al. teaches that the most photoactive phase is anatase (pg 57, Introduction), and thus it would have been obvious to one of ordinary skill in the art to use known means to achieve anatase phase  $\text{TiO}_2$ . Therefore, the creation of anatase phase titanium oxide in Takahashi, et al. is found to be inherent since a film of a different crystallinity would not be effectively photocatalytic, or alternatively the creation of anatase phase is the most desired phase.

Regarding the  $\text{ATiO}_3$  underlayer, Chambers, et al. teaches the use of epitaxy to grow co-doped  $\text{TiO}_2$  anatase onto a  $\text{SrTiO}_3$  substrate. The lattice mismatch between  $\text{SrTiO}_3$  and anatase titanium oxide is 3.1%. Despite this, heteroepitaxial growth is possible. The  $\text{SrTiO}_3$  serves as a base which creates anatase films of good crystalline quality. (pg 3467) Although Chambers, et al. teaches a Co-doped  $\text{TiO}_2$  film, this is not found to be excluded by the instant claims since the nature of doping preserves the structure and main properties of the main material, i.e. anatase titanium oxide. Claim 9 in the instant application additionally allows for dopants, demonstrating that dopants are within the scope of the claims.

One would have been motivated to use  $\text{SrTiO}_3$  as an underlayer because of the known ability for heteroepitaxy and the creation of anatase titanium oxide. The previously cited references show that anatase phase is desirable for photocatalysis. Although the film deposition techniques of Takahashi, et al. and Chambers, et al. are not exactly the same, the field of heteroepitaxy generally applies to many film growth techniques, including both sputtering and CVD. The method for creating this  $\text{ATiO}_3$



layer (e.g. claim 12) are not found patentable over the prior art since they are product by process claims.

Therefore, due to the motivation to create an effective photocatalyst layer, through the use of dopants or additional layers, claims 1-13 and 20 are not found patentable over the prior art.

4. Claims 1-13 and 20 rejected under 35 U.S.C. 103(a) as being unpatentable over Chambers, et al. ("Epitaxial growth and properties of ferromagnetic co-doped TiO<sub>2</sub> anatase", 2001), in view of Zhang, et al. ("Surface modification of TiO<sub>2</sub> film by iron doping..." 2003) and Doushita, et al. (US 6,576,344).

Chambers, et al. teaches a dual layer structure and the creation of a TiO<sub>2</sub> anatase phase as discussed above.

Regarding a photocatalytic ability, it is well known and demonstrated in the art that anatase titanium oxide possesses photocatalytic properties.

Regarding the thickness of the underlayer, Chambers, et al. teaches the use of a SrTiO<sub>3</sub> substrate. Since the function of the SrTiO<sub>3</sub> is heteroepitaxy, the thickness of the film is not found patentable over the prior art as long as it exists in an amount that is sufficient to grow the titanium oxide film.

Regarding process steps, such as the a lack of a heating step or the method of creating the film, since the instant claims are drawn to a structure or product, the product by process claims are not given patentable weight until it can be shown that the product is different as a result of these process steps.

Regarding the dopant, Chambers, et al. teaches the use of Co doping. Cobalt is a very similar metal to iron, both being in the “iron group” (Group VII) on the periodic table and both being magnetic metals. The use of iron is found to be an obvious alternative to the use of cobalt.

Chambers, et al. does not address a photocatalytic property. Chambers, et al. also does not mention that the glass substrate contains an additional layer below the underlayer. Chambers, et al. also does not teach an overlayer. Chambers, et al. also does not teach the use of N, Zr or Fe dopants in the TiO<sub>2</sub>-based layer.

Regarding photocatalytic ability and alternatively regarding the dopant, Zhang, et al. teaches the use of iron-doping in anatase titanium oxide to improve activity. Anatase titanium oxide is useful for its photocatalytic ability as discussed above. In order to make titanium oxide more reactive, it has been attempted to create composite semiconductors using transition metal doping. (pg 333) Since iron doping is also known in the art to create semiconductors, it would have been obvious to explore other metal dopants in the art of Chambers, et al. It would have also been obvious to use the similar film as created in Chambers, et al. for photocatalysis as it is in Zhang, et al.

Regarding the use of additional layers below the underlayer or layers above the overlayer, Doushita '344 offers the teachings as discussed above. Since anatase titanium oxide is a well known photocatalyst and optical component, it would have been obvious to use the material of Chambers, et al. as a photocatalyst and take the necessary measures to utilize the properties.

### ***Response to Arguments***

5. Applicant's arguments filed 3/26/2009 have been fully considered but they are not persuasive.

Applicant argues that the layer created by the prior art is not inherently an anatase film. However, as discussed earlier, the use of the specific type of sputtering is found to inherently create anatase. Alternatively, it is found to be advantageous to create anatase titanium oxide.

Applicant argues that an underlayer assisting in heteroepitaxial growth is not taught in the prior art. However, Chambers, et al. does teach that it is known to use an underlayer of  $\text{ATiO}_3$  to create anatase titanium dioxide, with a mismatch of 3.1%. Heteroepitaxy is field of study in film growth, which would have led one of ordinary skill in the art to employ known strategies.

Applicant is advised that the claims are drawn to a structure, which mainly involves two layers. The process steps and mechanisms in making the layers are not necessarily given patentable weight.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DIANA J. LIAO whose telephone number is (571)270-3592. The examiner can normally be reached on Monday - Friday 8:00am to 5:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 571-272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ngoc-Yen M. Nguyen/  
Primary Examiner, Art Unit 1793

DJL